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AFRL studies displayed at museum

by Larine Barr, AFRL Public Affairs

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Strap on a helmet and get in gear. Air Force Research Laboratory (AFRL) technologies to improve racecar driver protection are currently being featured as part of a special exhibit at the Boonshoft Museum of Discovery in Dayton.

The museum exhibit, called Racecar: The Science of Speed, explores the science behind Indy and NASCAR auto racing in an interactive learning environment. Featuring a Winston Cup racecar and a 1990 Porsche Indy car, Science of Speed opened Sept. 8 and continues through Jan. 12, 2003. The AFRL display reflects a portion of the exhibit that highlights safety systems and advancements in the racecar industry.

AFRL's Human Effectiveness (HE) and Materials and Manufacturing (ML) Directorates have created displays demonstrating their work on projects researching how to reduce driver and spectator injuries during crashes.

Through a Cooperative Research and Development Agreement with Trice Motorsports, the HE Directorate is collecting data on head and neck injuries using tiny sensors mounted in drivers' helmets and earplugs.

"We are analyzing the data to define impact tolerance and injury causation to better understand what causes certain injuries such as concussion," said Ted Knox, principal scientist with the directorate's Biodynamics and Acceleration Branch. "The information will also benefit pilots and civilian drivers."

So far, several racecar drivers such as former Indy racing champion Greg Ray, have used the helmet on various tracks. Knox said scientists will collect the data until 2007. The display at the museum depicting this research shows the two types of sensors

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A banner featuring "Racecar: The Science of Speed" hangs outside the Boonshoft Museum of Discovery in Dayton, Ohio. The exhibit which features technologies developed by AFRL runs through Jan. 12, 2003.

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http://extra.afrl.af.mil/news/index.htm

Technical Library shares information resources

by Fran Crumb, Information Directorate

ROME, N.Y. — A history of research dating back more than a half century has resulted in the Technical Library of the Air Force Research Laboratory's Rome Research Site being recognized throughout the world of radar as a valuable resource. The library makes its information resources on radar, signal processing and a variety of other electronics subjects available to many requesting institutions and individuals through interlibrary loans.

"During the past 10 months, the Technical Library has fulfilled 1,576 requests from outside organizations such as Syracuse University and the Massachusetts Institute of Technology, thereby spreading the benefit of tax dollars spent locally around the country," said chief librarian Mike Heines.

The Rome Research Site library is stocked with 23,000 books — primarily technical publications — as well as a large collection of technical magazines and journals. All are available through interlibrary loans.

Air Force research and development at Rome was established in June 1951 with the Rome Air Development Center. Radar technology was the primary focus of early activity, and the legacy continues with elements of the AFRL's Sensors Directorate still active at the Rome Research Site. **@**

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Pioneering lubricant research may lead to multi-purpose grease, landing gear solution

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Team gets ready to test flexible aircraft wings

by Larine Barr, AFRL Public Affairs

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Engineers are conducting final ground tests this month at NASA's Dryden Flight Research Center at Edwards Air Force Base, Calif., before beginning the first research flights on a project to demonstrate that aircraft wings can warp or twist in flight to enhance aircraft performance.

The Air Force Research Laboratory's Air Vehicles Directorate, Boeing's Phantom Works and NASA Dryden are collaborating on the effort, called the Active Aeroelastic Wing project. The goal of the program is to use lighter weight, flexible wings to improve the maneuverability of high-performance military aircraft, said Dryden's project manager Denis Bessette. "The project reflects both a return to aviation's beginnings — and a gateway to the future – a future where aircraft will sense their environment, morph and adapt their shape to existing flight conditions," said Bessette.

According to Pete Flick, the Air Force program manager for the project, Active Aeroelastic Wing technology is important to the Air Force because it represents a new approach to designing wings, and is applicable to a wide variety of future air vehicle concepts that are under study.

At high speeds, aircraft wings aeroelastically warp or twist. The team is researching a "wing warping" technology to control this warp or twist phenomenon. Another goal of the program is to investigate and test the wing technology on a manned supersonic aircraft. This research could also enable thinner, higher aspect ratio wings on future aircraft, which could result in reduced aerodynamic drag, allowing greater range or payload and improved fuel efficiency.

"The active aeroelastic wing design approach removes some constraints that limit conventional wing design, opening up the envelope for future designers," said Flick.

The last major ground test series leading up to the first flight began in late August at NASA Dryden and is expected to be completed in mid-September. During these evaluations, called ground vibration and structural mode interaction tests, engineers input vibrations into the aircraft and determine if these vibrations are controlled in the expected manner. The structural mode interaction test assures that vibrations caused by the flight controls are suppressed, rather than reinforcing each other to cause large, uncontrolled vibrations or flutter that could lead to catastrophic failure of the aircraft structure.

NASA Dryden technicians position a support cylinder under the right wing of the Active Aeroelastic Wing F/A-18 test aircraft before conducting the ground vibration tests. (Air Force photo by Tom Tschida, NASA Dryden)

In October, project managers hope to conduct the first round of research flights from NASA Dryden, using the wings on a modified F/A-18. The testbed aircraft, provided by the U.S. Navy, has been modified with additional actuators, a split leading edge flap actuation system and thinner wing skins that will allow the outer wing panels to twist up to five degrees. "We put the aircraft through a series of testing to characterize the changes as well as prove that the modified vehicle is safe to fly," said Flick. The two-phase flight tests will begin with a succession of about 30 to 40 parameter identification flights. The team expects the second phase of research flights to launch in mid- to late 2003.

"We've been successful to date, but the real test is when we start flying and we see how the flight data correlates to our predictions of aircraft response," said Flick. **@**

AFRL display (from page 1)

placed in drivers' helmets and earplugs, along with a crash data recorder used to record the acceleration of tested racecars during a crash.

Also on display is a special tether which incorporates fiber materials technology originally developed by scientists at the ML Directorate. The tether keeps tires and wheel assemblies attached to racecars during crashes. The ML Directorate developed a material called Polybenzobisoxazole (PBO), commercially known as Zylon™, which has dramatically strengthened the tether. Directorate scientists originally developed the sturdy material for high temperature Air Force needs. Similar in design to steel cables that support large suspension bridges, the cables consist of about 10,000 individual PBO fibers.

According to ML Directorate scientist Marilyn Unroe, in 1999 the Indy Racing League required that every car competing in the Indy 500 be equipped with a new Suspension & Wheel Energy Management System, which utilizes the Zylon™ tether to minimize the risk of wheels flying off during crashes.

"Motorsports is a traditional portal through which Air Force technology has been introduced into the civilian economy, multiplying the value of the taxpayers' investment, said Paul Lane Jr., DSNH Board of Trustees. "Local citizens need to know their Air Force neighbors are supporting technology development beyond military applications. In addition, the Boonshoft is a prime environment to fire their children's minds with the exciting science and engineering research at AFRL." **@**

Team demonstrates, validates portable laser coating removal system

by Timothy R. Anderl, AFRL Materials and Manufacturing Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — A team from the Air Force Research Laboratory (AFRL) and Air Force Materiel Command (AFMC) is demonstrating and validating commercially available, portable handheld lasers for coating removal. The process will be used to supplement existing depainting processes in an effective, environmentally safe manner.

The technology demonstration and validation program, part of the Joint Group on Pollution Prevention (JG-PP) process, is a partnership between various government organizations to validate and implement cleaner and cheaper processes at military and industrial facilities. The technology will be used by maintenance technicians at depots and Air Logistics Centers (ALCs).

AFRL's Pollution Prevention Research and Development Team (MLSC) and AFMC's Logistics Environmental Branch (LGP-EV) contributed technical and programmatic expertise to the effort, which is funded by the Environmental Security Technology Certification Program (ESTCP) and AFMC's Pollution Prevention Integrated Product Team, numerous Air Force weapon system programs, all of the Air Force ALC, the Army, Marines, Navy and the National Aeronautics and Space Administration (NASA).

Commercial and military aircraft frequently need to be paint-stripped to allow for inspection, maintenance, and nondestructive evaluation work. Off-the-shelf pulsed lasers, which are finding increased use in today's commercial operations to clean and de-coat a variety of materials, will offer significant benefits as a non-abrasive coating removal process. Currently, removing coatings requires using hazardous materials that generate large amounts of hazardous waste and pose a significant occupational health risk for workers performing this task. The Air Force expects large savings by eliminating or minimizing chemical purchases, their use and associated waste streams.

Pulsed lasers work by emitting a series of brief energy bursts while aimed at the surface of a coated material. As the energy is applied, the laser removes coating that has been applied to the material. On aircraft materials, the laser may be used to remove multi-layered paints, primers, or other special coatings. The process is repeated until the desired depth is reached, and can be tailored to strip at a specific depth to remove single layers of coating or paint while others remain intact.

"These lasers have proven useful in a variety of commercial arenas," said Thomas Naguy, the AFRL Materials and Manufacturing Directorate's (ML) team leader for the project. "So AFRL leveraged manpower and funding resources to identify this Air Force technology need, prototype the technology and begin working with our customers to fully implement the technology."

The prototype for this project was started in 1998, based on requirements developed by the Environmental Safety and Occupational Health Technology Integrated Product Team, now the Environmental Development Planning Team. In 2000, AFRL and AFMC teamed to identify the prototype technology, and to begin the demonstration, validation and technology transition process based on a Joint Test Protocol (JTP), which is a set of requirements used to qualify available commercial-off-the-shelf systems to meet joint service and NASA needs.

Harold Hall, a technician from ML's LHMEL facility, demonstrates the Carbon Dioxide laser by stripping a substrate coated with an Air Force JTP-approved coating. (Air Force photo)

"One of the successes of this project was that we were able to competitively leverage AFRL resources and technical skills for the demonstration and validation phase of the project," Naguy said. "When four laser technologies were selected for demonstration and validation, ML technicians from the Survivability and Sensor Materials Division's Laser Hardened Material Evaluation Laboratory (LHMEL) began demonstrating their operational capabilities."

Technicians from LHMEL will demonstrate two Neodymium Yttrium Alumina Garnet (ND:YAG) laser cleaning machines capable of producing 120 watts of average power, a diode laser with power capabilities reaching to 250 kilowatts average power, and a Carbon Dioxide (CO_2) laser with an average power of 520 watts.

ML's Logistics Systems Support Branch Coatings Technology Integration Office (CTIO) lent additional support to the effort by preparing specimens for testing, and assuming responsibility for coating and recoating materials. Materials samples they prepared, which included various substrate types including aluminum, Kevlar, fiberglass epoxy, and alloy steel, were coated with Air Force and Army paints as specified by the JTP. Additional testing, including substrate damage assessment and measuring temperature affects, was also conducted.

After a four-cycle strip and repaint process is conducted on the specimens, ML's Acquisition Systems Support Branch will conduct mechanical testing, including tensile and fatigue testing to characterize the laser's effects on the substrate.

Testing for this phase of the project will be completed by 2003, and the final procurement specification and technical order is anticipated to be complete by 2005. Currently, AFMC is creating a technical order, which will address laser operation and safety in the field. ***@***

Wright Scholar program develops future AF scientists and engineers

by Michael Kelly, AFRL Propulsion Directorate

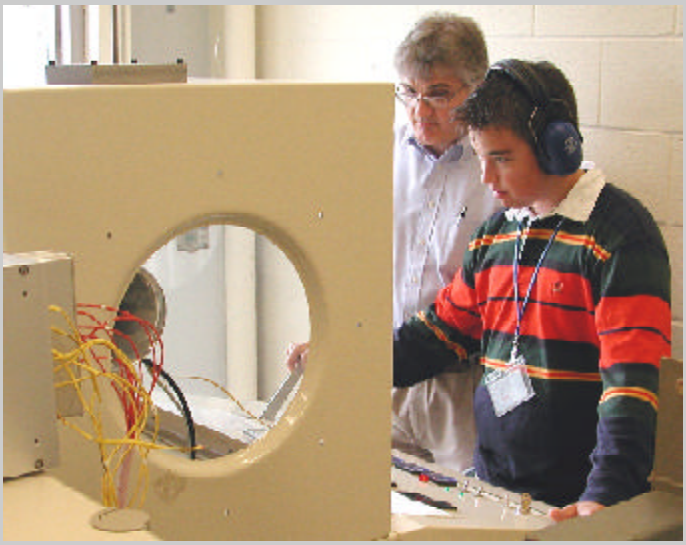
WRIGHT-PATTERSON AIR FORCE BASE, Ohio — While most of their friends were flipping burgers at the local fast food joint or just hanging out at the mall this summer, a select group of promising young scientists were experimenting with their future as research assistants in the Air Force Research Laboratory at Wright-Patterson Air Force Base.

Twenty-seven "Wright Scholars" joined a team of scientist and engineer mentors in the laboratory's Propulsion, Air Vehicles and Human Effectiveness Directorates for 10-weeks of hands-on exploration designed to "foster learning in the realm of science and engineering," said program manager John Horner, propulsion operations division.

The paid internship gave the selectees — from 19 different high schools — an opportunity to assist with on-site research and apply their knowledge of chemistry, physics and mathematics to various types of engineering careers, he said.

They also participated in a jet engine propulsion course taught at the Air Force Institute of Technology and attended weekly lectures with experts who discussed propulsion and power technologies.

The weekly lecture series was a surprising success, according to Horner. Topping the list of favorite subjects at the program's Friday lectures were presentations on pulsed detonation engines, scramjets, optics and lasers, combustion, rockets, and plasma research.



Dr. Paul King, associate professor of Aerospace Engineering in AFIT's Graduate School of Engineering and Management, keeps a watchful eye on 17-year-old Casey Holycross as he "runs up" a turbojet engine in a propulsion test cell. (Air Force photo by Steven Poland)

But the program's biggest payoff, according to Horner — himself a product of an similar internship program more than 30 years ago — was exposing these "enthusiastic and exceptional" students to the wonders of hands-on research.

"I co-op'd in college when I was studying to become a mechanical engineer at the University of Akron and it was a wonderful experience," he said. "I worked in the B.F. Goodrich research lab and factory. I actually designed tires. Through that experience I realized what a valuable program any kind of internship program is, and I tried to develop similar programs in this directorate."

When given the challenge to establish a work program that would show top high school students what engineering is all about, Horner knew he wanted to give today's youth the same hands-on experience he benefited from. "We also wanted to give them a chance to explore some of the career opportunities the Air Force has to offer," he said.

For the last 10 weeks, the scientists in training have joined forces with their assigned mentors to conduct individual research projects involving such esoteric issues as three-dimensional modeling of turbine engines, fuel composition analysis and hydrocarbon-fueled supersonic combustion engines. Other topics included studies in jet engine aerodynamics and combustion science.

Ultimately, Horner and his team of scientists and engineers are hopeful that the Wright Scholar program and others like it will generate a pool of highly qualified individuals the Air Force can draw on to fill looming critical shortages of scientists and engineers.

Of the Air Force's 13,300 military and civilian scientist and engineer authorizations, the service is short approximately 2,700 – or about 20 percent, according to Air Force Materiel Command personnel officials. And that's if they only had to fill current vacancies, not expected future shortages.

"We're an aging workforce and a significant number of our scientists and engineers will be eligible for retirement in the next five years," Horner explained. "That's what really motivated us in this program and other summer intern programs.

"We've got some brilliant kids in our local high schools who aren't familiar with the work we do out here. We thought, 'why not look in our own back yard?'" he said.

Senior leadership across AFRL and AFMC has seen the wisdom in that approach to developing the next generation of scientists and engineers and fully support the concept.

"We truly believe that any effort to develop future scientists and engineers will pay big dividends toward our own future, and to that of the Air Force," said Col. Alan Janiszewski, Director of AFRL's Propulsion Directorate.

The command's top engineer agrees.

"It's through the scientist and engineer corps that we sustain what's very important — technological dominance on the battlefield," said James Papa, AFMC engineering and technical management director. "It goes beyond just producing state-of-the-art systems, we need to have a robust scientist and engineer corps to be on the leading edge and stay ahead of our adversaries."

Horner and his team of mentors hope to make that a reality with efforts like the Wright Scholar program. **@**

Net Index

Due to the number of submissions we receive, some sections of *news@**afrl*** are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

L@b L@urels

- **IF engineer nominated for public service award**
- **Chief Scientist named as 2002 AIAA Fellow**
- **SME selects AFRL scientist as fellow**
- **Christe named as recipient of chemistry award**

Check out our online version to see the complete listing of Roundups

For more on these stories see news@afrl
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Wichita media view Airborne Laser

WICHITA, Kansas — With the Airborne Laser as a background, Col. Ellen Pawlikowski, center, director of the Airborne Laser System Program Office at Kirtland Air Force Base, N.M., briefs Wichita news media representatives on the aircraft, which recently flew following two years of major modifications. In addition to speaking to approximately a dozen news media on August 20, the colonel was interviewed for a program titled "Ultimate 10: Military Machines" that will air on The Learning Channel. (Air Force photo) @

To view the full text of these and other articles visit the *news@**afrl*** page on the Internet at http://extra.afrl.af.mil/news/index.htm.

To submit L@b L@urels or Roundups from your directorate, send a query to AFRL Public Affairs at:

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